16. SOME OBSERVATIONS ON THE GROWTH OF CAPTIVE CROCODILES

(With five text-figures)

Two species of crocodiles—*C. palustris* and *C. porosus* were reared in captivity to evaluate the feasibility of growing them in view of the commercial importance of their skins. The effect of physical factors of environment on their growth rates have been statistically analysed. The economics of their rearing is also indicated.

INTRODUCTION

It has been known for a long time that illegal poaching encouraged by the high profitability of foreign trade in crocodile skins has reduced the crocodile population in India almost to the verge of extinction (Misra 1970). Information regarding crocodile farming on a commercial scale is sparse except for those of Youngprapakorn *et al.* (1971). This had necessitated the urgent need for setting up of crocodile farms which has assumed importance after the survey by Bustard (1974). In view of these considerations an attempt was made in this Institute to rear *C. palustris* and *C. porosus* in captivity. The difference in growth rates between these two species has already been mentioned (Krishnamurthi and Bhaskaran 1976). The present paper throws more light on the effect of climatic conditions

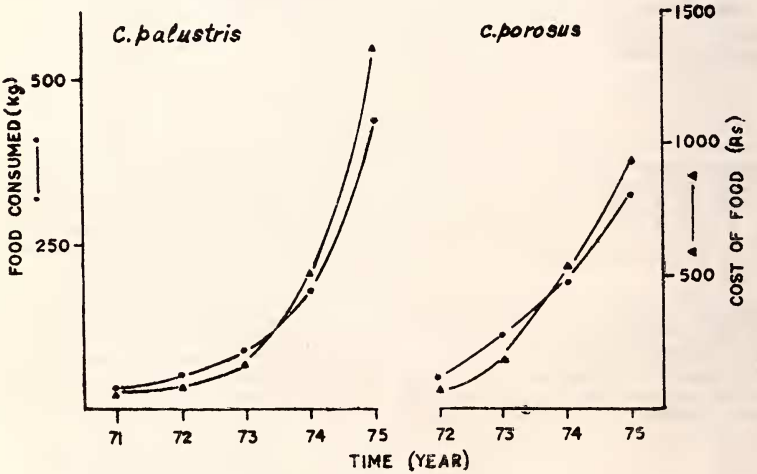

Fig. 1. Food consumption by *C. palustris* and *C. porosus*.

and food on their growth in captivity. The cost of rearing them under artificial conditions is also indicated as an aid for commercial farming of crocodiles.

Materials and Methods

C. palustris: Sixteen hatchlings of about 15 days old were obtained from Chidambaram, Tamilnadu in 1970. Two of them died within a week while eight of the remaining died at different intervals during the course of the year. Of the remaining, one was transferred to the Snake Park, Madras for observation and only five were maintained for further study.

*C. porosus*s Eight specimens, ranging from $1\frac{1}{2}$ to 2 years old were imported from Singapore in March 1972 to compare the rate of growth with that of *C. palustris*. One of them died within 15 days after an attack of paralysis of hind limb and another two during the year. Five survived for the full study period.

Rearing Tanks:

In the early stages, juveniles of *C. palustris* were reared in wooden tubs and small cement tanks and later transferred to big tanks. Two tanks, measuring $21' \times 14'$ and $14' \times 9'$ respectively with 3′ depth (Pooley 1971) were used from February 1973. The two species were segregated according to their sizes. The sides and the roof of the enclosure were covered with wire netting against predators.

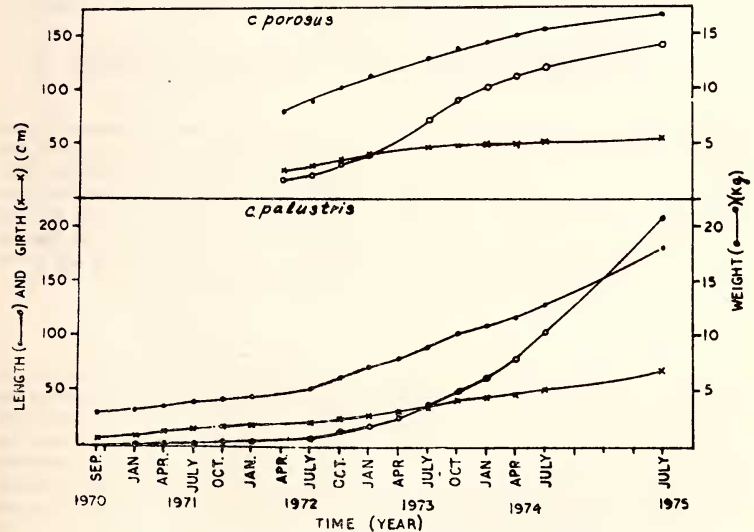

Fig. 2. Growth measurements of *C. palustris and C. porosus.*

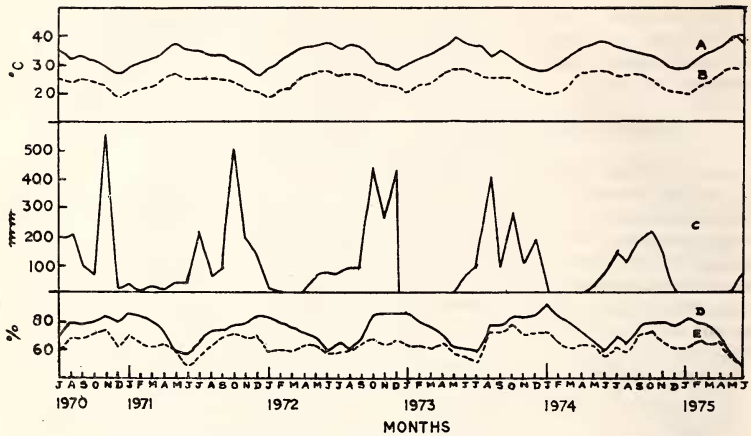

Fig. 3. Meteorological data for the period July 1970 to June 1975.
A—Maximum Temperature; B—Minimum Temperature; C—Monthly total rainfall; D. Relative humidity at 08.30 hrs; E—Relative humidity at 17.30 hrs.

Food: The food consisted of beaf, live frogs and fish. Feeding with live frogs was discontinued from April 1973, due to non-availability of sufficient size and numbers. As daily feeding resulted in too much left over food the feeding intervals were reduced. In summer feeding was done on alternative days and in cold months on every third day (October to January).

Data analysis:

Using multiple regression analysis, the relationship between length, girth and weight was analysed using IBM—370/155. The values of R^2 and chi-square (*C. palustris*, $R^2 = 0.98$, chi-square (74 df) = 21.02, *C. porosus*, $R^2 = 0.96$, chi-square (49 df) = 11.05) were very highly significant showing a high order of correlation between length, girth and weight. In view of this, length has been taken as a parameter to decide the growth rate. Since rainfall which is a discrete factor can only have a cumulative effect on this growth, the effect of cumulative rainfall on the length has been worked out on the assumption that line correlationship exists between rainfall and growth (Arkin and Colton 1967).

Results

It is known that juvenile crocodiles develop deformities like hunchback when fed with beef alone (Coulson *et al.* 1973). This was also observed in the present investigation with juvenile *C. palustris* exhibiting deformities under similar feedings. There was considerable improvement in growth with a change in diet to live frogs and fish. Further, the

young ones took about two weeks to adapt themselves to the new surroundings when shifted from smaller to larger tanks. The other species under the present study namely *C. porosus* was fed with live frogs and fish from the beginning and the growth was observed to be normal. The consumption of food initially by *C. palustris* was very poor and with the increase in its size it doubled every year from 1972 onwards. In the case of *C. porosus* there was a drop in the food consumption (Fig. 1) from 1973. It was estimated that the cost of feeding of *C. palustris* for 58 months amounted to Rs. 2170/- while as with reference to *C. porosus* it was Rs. 1735 for 40 months.

The growth rate of the two species was recorded at regular intervals. It included length, girth and weight and the average measurements of five individuals of each spe-

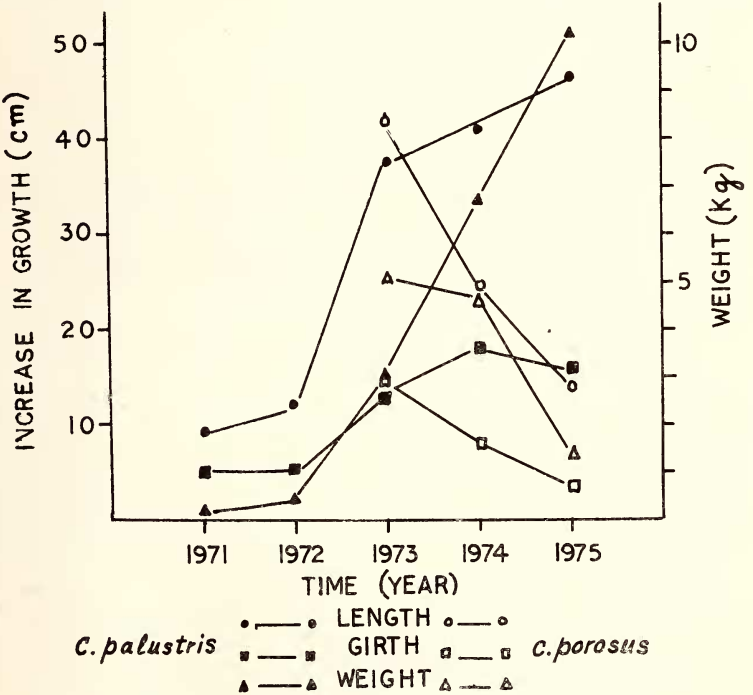

Fig. 4. Average increase in growth rate per year (July-June).

cies are presented in Fig. 2. It was observed that in the case of *C. palustris* the average maximum figures for length, girth and weight were 176 cm, 67 cm, and 20.5 Kg respectively while in *C. porosus* these were 167 cm, 55 cm and 13.7 Kg. in the same order. As between two species, the annual growth rate of *C. porosus* seems to be influenced to a considerable extent by annual cumulative rainfall while *C. palustris* seems to maintain a steady increase in its growth rate. As indicated in Fig. 3 the annual rainfall increased steadily from 1970, to 1525 mm in 1972, and it decreased during the years 1973 and 1974 to 1191 and 873 mm respectively. However, there was no significant difference in the temperature and the relative humidity during the year of study.

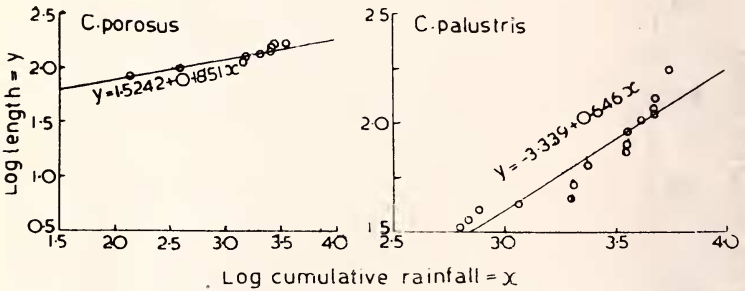

Fig. 5. Scatter diagram—relationship between cumulative rainfall and length of Crocodile.

Discussion

In assessing the factors influencing the value of the skins it is obsrved that as between food and environmental factors, the latter especially the cumulative rainfalls plays a more effective role than the former (Youngprapakorn *et al.* 1971). There also seems to be a certain relationship between the urge to consume food and the amount of rainfall, a decrease in rainfall resulting in aversion to food in general, which is more pronounced in the case of *C. porosus*. Similar observations were made with alligators (Coulson *et al.* 1973). *C. palustris* showed a steady increase in its annual growth rate from 9.1 cm long in 1970-71 to 11.7 cm in 1971-72, 37.7 cm in 1972-73, 41 cm in 1973-74 and 44.5 cm in 1974-75, while *C. porosus* affected by rainfall, recorded a decrease from 41.7 cm in 1972-73 to 24.3 cm in 1973-74 and 14.2 cm in 1974-75 (Fig. 4). This observation has been substantiated by statistical analysis (Fig. 5) in which it is highlighted using a log plot of the length against the cumulative rainfall. The log-linear relationship is evident from the gord fit and a regression equation is generated to explain the relationship. In the case of *C. porosus* the regression equation is log (length) = 1.5242 + 0.1851 log (cumulative rainfall) while in *C. palustris* it is log (length) = —3.339 + 0.646 log (cumulative rainfall).

After the period of this study the crocodiles were transferred to a natural habitat.

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REFERENCES

ARKIN, H. & COLTON, R. R. (1976): Statistical Methods. Barnes & Noble Inc. New York.

BUSTARD, H. R. (1974): A preliminary survey of the prospects for Crocodile farming (UNDP, Food and Agricultural Organization of the United Nations, Rome FO: INS/71/033).

COULSON, T. D., COULSON, R. A. & HERNANDEZ, T. (1973): Some observations on the growth of captive alligators. *Zoologica.* Scientific contributions of the New York Zoological Society. *58*(2): 47-52.

KRISHNAMURTHI, V. S. & BHASKARAN, R. (1976): Growth studies on the species of Crocodiles in captivity. *J. Bombay nat. Hist. Soc., 73*(3): 532-533.

MISRA, R. N. (1970): The endangered crocodiles of India. IUCN Publ. (N.S.) No. *18*: 77-81.

POOLEY, A. C. (1971): Crocodiles rearing and restocking IUCN publications on the proceedings of the First working Meeting of Crocodile specialist group held in USA 1:104.

YOUNGPRAPAKORN, U., CRONIN, B. N., & MCNEELY, J. A. (1971): Captive breeding of Crocodiles in Thailand. In Crocodiles Intern. Union Consen. Nat. Publ. New series, Suppl. Pap. *32*: 98-101.

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17. A NEW TURTLE FOR NEPAL

In their appendixed review of the Nepal herpetofauna, Swan and Leviton (1962:135) list the turtle *Kachuga tecta,* family Emydidae, as a hypothetical species and note that it occurs in the adjacent plains of Nepal, defined as "the plains of India within approximately 50 miles of the southern frontier of Nepal." They further state that for west, central, and east Nepal they suspect the "possible presence of the species in Nepal based on the known presence of the species on the plains of India adjacent to Nepal." I would now like to report the first authenticated specimen in Nepal.

On the 27 of May, 1977, I caught, photographed, and released an individual of this species in Janakpur, Dhanusa district, of east Nepal. The total carapace length measured 8.5 cm. I had earlier seen two turtles of this species at the Janakpur fish farm in January of that year. I subsequently again captured individuals of *K. tecta* at the Janakpur fish